

REMARKS

This Amendment is submitted in response to a non-final Office Action mailed March 3, 2009. Claims 8-14 are pending. Claims 9-12 stand rejected under 35 U.S.C. §112, second paragraph. Claims 8-14 stand rejected under 35 U.S.C. §§102(b) and 103(a). In response, Applicants have amended claims 8 and 10-14, cancelled claim 9, and added new claims 15-24. No new material has been added by way of these amendments.

In the Office Action, claims 9-11 are rejected under §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claims 9-11 were deficient due to an antecedent basis issue, specifically, that both depended from a non-existent claim 1. In response Applicants have amended these claims to correctly depend from claim 8.

Claim 10 was further rejected under §112, second paragraph, because the Patent Office alleges that the term “working temperature” is unclear. Applicants respectfully disagree. As the Patent Office has observed, several examples are provided in the Examples of hydrophobic polymers with varying glass transition temperatures. Which polymer hydrogel is selected using certain glass transition temperatures will depend in the working conditions of the polymer actuator into which that polymer hydrogel is used. However, the fact that the working temperature is not specified does not make the claim indefinite. The claim language sets forth a specific limitation – the correlation between the working temperature and the glass transition temperature. It further defines a specific characteristic of the water insoluble polymer at that working temperature- the rubbery characteristic as described within the specification that imparts high break strength to the polymer hydrogel. This does not render the claim indefinite because one of ordinary skill in the art would understand that a polymer hydrogel used in a warmer environment, e.g. within a machine, may utilize a material with a higher glass transition temperature than one that operates at a colder temperature. For this reason, Applicants assert that this aspect of claim 10 is not indefinite, and respectfully request the rejection be withdrawn.

In the Office Action, the Patent Office rejects that claims 8-9, 11 and 14 under §102(b) as anticipated by U.S. Patent Application Publication No. 2002/0001571 (hereinafter “Wu.”) Applicants respectfully disagree with this rejection and traverse with respect to previous claim 9 as represented by instant claim 8. Applicants assert that Wu does not teach each and every

aspect of the claimed invention. Wu does not teach a stimuli-responsive hydrogel comprising a water-insoluble polymer and a stimuli-responsive polymer capable of gelating and changing its degree of swelling in response to a stimuli, and does not teach a water-insoluble polymer without crosslinking.

Wu does not teach the polymer hydrogel that changes its swelling amount with a stimulus. Wu teaches that the nanoparticles can be used in a membrane system to create valves that can change in size, and that the change in size will form channels in response to the stimuli. This allows Wu to create membranes that contain channels for the passing of solutes or liquids through the membrane. However, this does not indicate the creation of a hydrogel with both a stimuli-responsive polymer and a water insoluble polymer, as required by the claims. Furthermore, the product does not disclose the claimed overall hydrogel material which will change in size via absorption and desorption of water in response to a stimuli. Instead, Wu creates nanoparticles that may be embedded within membranes. The nanoparticles can be crafted with special properties. However, the nanoparticles do not have both the stimuli-responsive polymer and the water-insoluble polymer that form a hydrogel.

Furthermore, Wu does teach crosslinking within the nanoparticles. Specifically, in the limited disclosure set forth in Wu, the exemplary nanoparticles are prepared using a crosslinking agent, N,N'-methylenebisacrylamide. [0047]. In contrast, the Patent Office's defense of this limitation is to extrapolate from a single paragraph in the background to the conclusion that crosslinking is not present. Specifically, the Patent Office asserts that paragraph [0007] in Wu states that existing membrane systems are prepared by crosslinking, grafting, or radical polymerization, and, because Wu allegedly overcomes this limitation, it must therefore not have crosslinking present in the process. This argument simply fails because Wu does describe crosslinking. Moreover, the assertion that the prior art contains some element does not prove that the converse is true – it does not prove that the disclosure does not contain crosslinking. The problems allegedly solved by the disclosure may be overcome in other ways. Conclusively presuming that the disclosure eliminates the limitation because the prior art had it is improper, absent a showing in the disclosure that the element is not present.

For these reasons, Applicants assert that the rejections in view of Wu are improper and respectfully request that they be withdrawn.

In the Office Action, the Patent Office asserts that Claims 8-9, 11, and 14 are anticipated by U.S. Patent Application Publication No. 2003/0170308 (hereinafter “Cleary.”) Instant claim 8 as amended requires the limitation of a water-insoluble polymer as a phase separation structure which does not contain crosslinking points. Applicants assert that Cleary fails to meet this limitation. Specifically, Cleary teaches that the hydrophobic polymer that forms the phase separation structure is crosslinked. “For most applications, the **crosslinked** hydrophobic polymer should have a **sufficiently high degree of crosslinking**” Cleary, [0059].

To overcome this clear teaching, the Patent Office points to the plasticizer in Cleary as containing elements which are not crosslinked and therefore meet the limitations in the claim. Applicants first of all note that the hydrophobic polymer as claimed by the Applicants must be both the phase separation structure and also not crosslinked. Therefore, the hydrophobic polymer of [0059] is the relevant structure, and the disclosure of the plasticizer is inapplicable. For this reason alone, the rejection is improper.

Second, even if it were appropriate to apply the plasticizer as water insoluble polymer, the clear teaching of Cleary is that the plasticizer be used within the hydrophobic phase in combination with the crosslinked hydrophobic polymer. No teaching or suggestion within Cleary indicates that the plasticizer be applied in the absence of the crosslinked hydrophobic polymer. In effect, the Patent Office is asserting that the plasticizer and the hydrophilic polymer can be used in the absence of the hydrophobic polymer. This is clearly not what Cleary teaches. Cleary teaches that the hydrophobic polymer must be present, and that crosslinking is a critical part of that material. “The discontinuous hydrophobic phase includes at least the following components: a hydrophobic polymer, a plasticizer...” Cleary, [0011]. For this reasons, Applicants assert that the limitation of a water-insoluble polymer as a phase separation structure that is without a crosslinking point is not present in Cleary, and that the rejection should therefore be withdrawn.

In the Office Action, the Patent Office rejects claim 10 under §102(b) as being anticipated by Cleary with evidence provided by Kraton Labels (2009), a website. Specifically, the Patent Office is relying on Kraton Labels to prove that a styrene isoprene plasticizer when combined with styrene butadiene styrene copolymer will provide adhesives with extremely low glass transition temperatures. Based on this evidence from Kraton, the Patent Office concludes

that T_g below room temperatures would be achievable. In rebuttal, Applicants first note as a general rule that just because two polymers containing the same component monomers does not provide proof that the two polymers are the same. For example, polypropylene consists of propylene monomers, but the polymerization of those monomers across different catalysts will yield different polymer properties, e.g. for isotactic, syndiotactic, or atactic polypropylene. Similarly, when polymerizing isoprenes or butadienes, with other olefins, the 1,4-polymerization is required to eliminate crosslinking across the entire polymer material. 1,2 polymerization will lead to a pendant olefin that can crosspolymerize with another olefin. So, post-critical date evidence that Kraton Labels provides certain plasticizers that are linear does not conclusively show that the disclosure in Cleary necessarily is also linear.

Moreover, regardless of what the actual chemical formula and structures of the Kraton Label products are, Applicants note that this conclusion still fails to resolve the issue of crosslinked polymers present in the base independent claim. The Patent Office is asserting that this material will lower the glass transition temperature of the hydrophobic polymer to below room temperature. However, that hydrophobic polymer is crosslinked, as discussed above. Therefore, this evidence does not resolve the deficiency present in Cleary above, so this rejection is also improper.

In the Office Action, the Patent Office rejects claims 8, 11, 13-14 under §102(b) as anticipated by U.S. Patent 6,331,578 (hereinafter "Turner.") Applicants note that claim 9 was not rejected as anticipated by Turner, so the §102(b) rejection is moot in view of the amendments to the claims. However, claims 9, 10 and 12 are further rejected under §103(a) as being unpatentable over Turner, as a single reference. In rejecting claim 9, the Patent Office asserts that Turner teaches semi-interpenetrating networks where one or more of the polymer components remains linear, and therefore that one of ordinary skill in the art would recognize that this disclosure would be used to prepare those networks. Applicants respectfully disagree, and assert that nothing within Turner provides an enabling disclosure for the proposed conclusion.

The entirety of Turner teaches crosslinking as applied to a very specific preparation of IPNs. The disclosure in Turner attempts to overcome problems associated with preparing IPNs of bicontinuous hydrophobic/hydrophilic IPN membranes having a uniform composition. To

do so, the IPNs are created by mixing solutions of two components and a crosslinker on a surface that minimizes surface segregation of the incompatible components, and effecting polymerization of the components in the presence of the crosslinker. In every aspect of the invention in the Summary in Turner, polymerization and crosslinking take place in the IPN. See col. 4, ln. 64, col. 5, ins. 2, 26, 31, 52-53, 56; col. 6, ins. 11, 14, 17. In the Detailed Disclosure in Turner, the specific disclosure of the hydrophobic networks gives very thorough details of the crosslinking of the hydrophobic polymer network. See col. 9, ln. 49 to col. 11 ln. 10. (“Suitable crosslinking agents for the hydrophobic material...” “Molecular weight between crosslinks (M_c) of the hydrophobic polymer network...” “Control of M_c of the [hydrophobic network]..”) The very clear teaching of Turner is that crosslinking is required to control the nature of the IPNs created in it.

In contrast, other than the single statement cited by the Patent Office, nothing within Turner teaches or suggests that the IPNs of Turner would or should be created without crosslinking. Furthermore, Turner goes to great details to describe how an IPN of bicontinuous hydrophobic/hydrophilic material can be made and controlled. That control is with crosslinking of the components when creating the IPN. Nothing in Turner enables one of ordinary skill to make IPNs without crosslinking and the clear disclosure in Turner suggests just the opposite. In order to overcome the challenge of creating a bicontinuous hydrophobic/hydrophilic IPN, crosslinking of the polymers under proper chemical constraints must be achieved. Turner provides no teaching to the contrary and therefore fails to make the claimed invention obvious.

In each of the above rejections, the Patent Office has rejected claim 14 based on the rationale that the preamble of claim 14, a polymer actuator, is not a limitation to the claim and can be ignored. Applicants respectfully disagree. Applicants first note that, in addition to the reasons set forth above with respect to the novelty of the claims for the stimuli responsive hydrogel, claim 14 and claims 15-20 that depend therefrom are patentably distinct from the cited references because nowhere in the references is described an actuator using the claimed hydrogel. Applicants note that several places within the specification discuss the use of hydrogels for polymer actuators. One aspect of the hydrogel materials is preparing the hydrogel with a linear water-insoluble polymer because crosslinked polymers do not provide the necessary high breaking strength when the hydrogel is used within an actuator. Paragraphs [0028]-[0030].

Moreover, when analyzing the stimuli-responsiveness of the hydrogel, the goal of fast responsiveness of the hydrogel to the stimuli is necessary to produce an actuator that responds quickly. Paragraph [0034]-[0035]. The result of the absorption or desorption of water causes a force to be applied to the polymer actuator to via a contraction or expansion of the hydrogel in the actuator. As a result, a polymer actuator crafted containing a stimuli-responsive hydrogel will accomplish work by the expansion and contraction of the hydrogel. Thus, the preamble in claim 14 is significant because it breathes life the claim because it defines one of the reasons for creating the claimed hydrogels having high elasticity and stimuli-responsiveness. For these reasons, Applicants assert that claims 14-20 should be limited to a polymer actuator using the stimuli-responsive polymer hydrogel and thereby overcomes the anticipatory rejections cited by the Patent Office.

For the above reasons, Applicants assert that the claimed invention is novel and non-obvious over the cited references. Applicants respectfully request that the rejections be withdrawn and that the application is in condition for allowance. The Commissioner is hereby authorized to charge deposit account 02-1818 for any fees which are due and owing.

Respectfully submitted,

K&L GATES LLP

BY 

Thomas C. Basso
Reg. No. 46,541
Customer No. 24573

Dated: June 22, 2009